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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/754,811	01/04/2001	William U. Liu	TI-21676	3477

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EXAMINER	
HOGAN, MARY C	
ART UNIT	**PAPER NUMBER**
2123	4

DATE MAILED: 05/14/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	09/754,811	LIU ET AL.	
	Examiner	Art Unit	
	Mary C Hogan	2123	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on 04-06-01.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) 1-20 is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) 1-20 is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☒ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on 1-4-01 is/are: a)☐ accepted or b)☒ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

1. This application has been examined.

2. Claims 1-20 have been rejected.

Information Disclosure Statement

3. Equation 1 in the specification is admitted prior art "popular smoothing function" (page 2, line 21). However, there is no reference given as to where this prior art equation can be found. It is requested that an IDS be filed providing such reference.

4. It is also noted that the applicant is the author of the following book: "MOSFET Models for SPICE Simulation including BSIM3v3 and BSIM4" (John Wiley & Sons, Inc. 2001). Although the copyright date of this book is later than the priority date of the application and cannot be used as prior art, the book discloses the equation discussed in paragraph 2 and would have been helpful to the examiner to have this reference disclosed at the beginning of examination.

5. Applicants are reminded of their duty to disclose all information known to be material to patentability as per 37 CFR 1.56.

Priority

6. Domestic priority referring to provisional application serial number 60/174,491 filed on 1/04/2000 is acknowledged.

Drawings

7. Figures 1, 2 and 3 should be designated by a legend such as --Prior Art-- because only that which is old is illustrated as indicated in the Brief Description of the Drawings. See MPEP § 608.02(g). A proposed drawing correction or corrected drawings are required in reply to the Office action to avoid abandonment of the application. The objection to the drawings will not be held in abeyance.

Specification

8. The disclosure is objected to because of the following. Appropriate correction is required.

9. The following are grammar and incorrect representations of formulas and/or symbols:

10. Page 5, line 2: "models".

11. Page 11, line 9 and 15: "♠".

Claim Objections

12. **Claims 12-20** are objected to under 37 CFR 1.75(c), as being of improper dependent form for failing to further limit the subject matter of a previous claim. Applicant is required to cancel the claim(s), or amend the claim(s) to place the claim(s) in proper dependent form, or rewrite the claim(s) in independent form. For example, **Claim 11** discloses "a continuous parametric model", but dependent **Claims 12-20** disclose a "continuous parametric model ***method***". Thus, the dependent claims do not further limit intervening claims.

Claim Rejections

35 USC § 112

13. The following is a quotation of the first paragraph of 35 U.S.C. 112:

> The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

14. **Claims 1-20** are rejected under 35 U.S.C. 112, first paragraph, because the specification, while being enabling for a "base model" as in equation 1 **(page 2, line 23, spec)**, does not reasonably provide enablement for "various other base models" as alleged **(page 12, lines 5-8, spec)**. The specification does not enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to use the invention commensurate in scope with these claims.

15. **Claims 3 and 13** are rejected under 35 U.S.C. 112, first paragraph, because the specification, while being enabling for one compensation function substituted into the base model in place of δ as specified in the claims, does not reasonably provide enablement for more than one compensation function to be substituted for δ as alleged by the terminology "at least one" in the claims. The specification does not enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to use the invention commensurate in scope with these claims.

16. The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

17. **Claims 1-20** are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

18. The variables of the equations disclosed in **Claims 1-20** are not defined and render the claims indefinite. The terms A_{eff}, A_0, A, and K are not defined by the claims, the specification does not provide a standard for ascertaining the requisite degree, and one of ordinary skill in the art would not be reasonably apprised of the scope of the invention.

19. In **Claims 5 and 15**, the term "second compensation function" is not defined and therefore, renders the claim vague and indefinite.

20. In **Claims 6 and 16**, the term "significantly less" merely implies some unspecified range of parameters, rendering the claim vague and indefinite. This term is not defined by the claims, the specification does not provide a standard for ascertaining the requisite degree, and one of ordinary skill in the art would not be reasonably apprised of the scope of the invention.

21. **Claim 11** provides for the use of a "compensation function" and a "compensation constant" to remove and prevent discontinuities of the base model and its first derivative, but, since the claim does not set forth any steps involved in the method/process, it is unclear what method/process applicant is intending to encompass. A claim is indefinite where it merely recites a use without any active, positive steps delimiting how this use is actually practiced.

22. **Claims 1-10** are rejected under 35 U.S.C. 112, second paragraph, as being incomplete for omitting essential steps, such omission amounting to a gap between the steps. See MPEP § 2172.01. This refers to "applying at least...". This terminology fails to disclose how these compensation terms are applied to the base model.

23. **Claims 11-20** are rejected under 35 U.S.C. 112, second paragraph, for being directed to both a method and an apparatus and therefore, indefinite (See MPEP 2173). **Claim 11** discloses "continuous parametric model" and **Claims 12-20** disclose "continuous parametric model method". Since Claim 11 does not refer to a method, the method steps in **Claims 12-20** are ambiguous.

24. **Claims 11-20** are rejected under 35 U.S.C. 112, forth paragraph for failing to specify a further limitation of the subject matter claimed. **Claim 11** discloses "continuous parametric model" and **Claims 12-20** disclose "continuous parametric model ***method***". The addition of "method" to the dependent claims adds additional material to the claimed subject matter.

35 USC § 101

25. 35 U.S.C. 101 reads as follows:

> Whoever invents or discovers any new and useful process, machine, manufacture, or composition of matter, or any new and useful improvement thereof, may obtain a patent therefor, subject to the conditions and requirements of this title.

26. **Claims 1-20** are rejected under 35 U.S.C. 101 because the claimed invention is not supported by an asserted or well established utility and is not tangible.

27. An invention, which is eligible for patenting under 35 U.S.C.101, is in the useful arts when it is a machine, manufacture, process or composition of matter, which produces a concrete, tangible, and useful result. The fundamental test for patent eligibility is thus to determine whether the claimed invention produces a ***useful, concrete and tangible result.*** The test for practical application as applied by the examiner involves the determination of the following factors:

> (1) Useful- The Supreme Court in *Diamond v. Diehr* requires that the examiner look at the claimed invention as a whole and compare any asserted utility with the claimed invention to determine whether the asserted utility is accomplished. Applying utility case law the examiner will note that:
>
> (a) the utility need not be expressly recited in the claims, rather it may be inferred.
>
> (b) if the utility is not asserted in the written description, then it must be well established.
>
> (2) Tangible - Applying *In re Warmerdam*, 33 F.3d 1354, 31 USPQ2d 1754 (Fed. Cir. 1994), the examiner will determine whether there is simply a mathematical construct claimed, such as a disembodied data structure and method of making it. If so, the claim involves no more than a manipulation of an abstract idea and therefore, is nonstatutory under 35 U.S.C. 101. In *Warmerdam* the abstract idea of a data structure became capable of producing a useful result when it was fixed in a tangible medium which enabled its functionality to be realized.
>
> (3) Concrete- Another consideration is whether the invention produces a concrete result. Usually, this question arises when a result cannot be assured. An appropriate rejection under 35 U.S.C. 101 should be accompanied by a lack of enablement rejection, because the invention cannot operate as intended without undue experimentation.

28. Furthermore, although the claims are interpreted in light of the specification, limitations from the specification are not read into the claims. See *In re Van Geuns*, 988 F.2d 1181, 26 USPQ2d 1057 (Fed. Cir. 1993).

29. **Claims 1-20** are rejected under 35 U.S.C. 101 because they appear to be reciting a mathematical algorithm, therefore not producing a concrete, useful and tangible result.

30. **Claims 11-20** are rejected under 35 U.S.C. 101 because the claimed recitation of a use, without setting forth any steps involved in the process, results in an improper definition of a process, i.e., results in a claim which is not a proper process claim under 35 U.S.C. 101. See for example *Ex parte Dunki*, 153 USPQ 678 (Bd.App. 1967) and *Clinical Products, Ltd.* v. *Brenner*, 255 F. Supp. 131, 149 USPQ 475 (D.D.C. 1966). For example, **Claim 11** provides for the use of a "compensation function" and a "compensation constant" to remove and prevent discontinuities of the base model and its first derivative, but does not set forth any steps involved in the method/process.

35 USC § 103

31. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

32. The factual inquiries set forth in *Graham* v. *John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

33. **Claims 1-5 and 11-15** are rejected under U.S.C. 103 (a) as being unpatentable over **Liu or Cheng** [(Liu et al ("BSIM3v3.2.2 MOSFET Model User's Manual", Weidong Liu et al, The Regents of the University of California, 1999), herein referred to as **Liu**) or (Cheng et al ("A Physical and Scalable I-V Model in BSIM 3v3 for Analog/Digital Circuit Simulation", Cheng et al, IEEE Transactions on Electron Devices, Vol. 44, No. 2, February 1997), herein referred to as **Cheng**)], in view of **Park or Barby** [(Park et al ("A Charge Sheet Capacitance Model of Short Channel MOSFET's for SPICE", Park et al, IEEE Transactions on Computer-Aided Design, Vol. 10, No. 3, March 1991), herein referred to as

Park) or (Barby et al ("Polynomial Splines for MOSFET Model Approximation" Barby et al, IEEE Transactions on Computer-Aided Design, Vol. 7, No. 5, May 1998), herein referred to as **Barby**)].

34. As per **Claims 1, 2, 11 and 12, Liu or Cheng** disclose a smoothing function of the form of the base model disclosed in **Claim 2 and 12 (Liu page 3-13 equation 3.6.4, Cheng page 281 equation 39).** This smoothing function is used in MOSFET model simulation to describe Vds at the transition between linear and saturation regions **(Liu page 3-13)** where a variable parameter δ, or delta, effects the sharpness of the curve **(Cheng page 281, Figure 2)**.

35. **Liu or Cheng** do not expressly teach determining if the model and its first derivative exhibit discontinuities.

36. **Park or Barby** disclose that all MOSFET models available in SPICE, such as the model disclosed in **Liu or Cheng**, are piecewise-sectional models in which different sets of model equations are used for different operating regions and that while current and charges are usually continuous at boundaries between operating regions, their derivatives may discontinuous due to insufficient care in the definition of the equations or mistakes in the program. These discontinuities cause convergence problems in transient circuit simulation **(Park page 377, 2nd paragraph and Barby Page 558, column 1). Park or Barby** further teach MOSFET models that eliminate the discontinuities encountered in MOSFET models such as **Liu or Cheng**.

37. It would have been obvious to one of ordinary skill in the art at the time the invention was made to determine if the MOSFET model and its derivative, as described by **Liu or Cheng,** exhibit the discontinuities described by **Park and Barby** and if so, to modify the **Liu or Cheng** model and its derivative with a compensation function or constant to eliminate the discontinuities encountered in both the function and its derivative since they both cause convergence problems in simulation **(Park page 377, 2nd paragraph, Barby page 558, column 1, paragraph 1).**

38. As per **Claim 3, 4, 5, 13, 14**, and **15, Liu or Cheng** do not expressly teach the substitution of a function for δ or A_0 in the smoothing function.

39. **Park or Barby** explicitly teach the generation of MOSFET models that incorporate smoothing functions. **Park** discloses a MOSFET model, using a function, S(z), to make a smooth transition for VDS between linear and saturation regions **(page 379, equation 9)**. This function is further used to compute a cubic spline function and coefficients that are used to smooth the curve of VDS **(Park, page 380, equation 10)**. The additional function guarantees the continuity of surface potential and its first and second derivative with respect to applied biases **(Park, page 379, lines 9-10). Barby** discloses a method

for evaluating MOSFET transport-current functions in the linear and saturation region by using quadratic spline approximation **(Barby page 558, column 1, last 3 paragraphs)**.

40. It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the parameter, δ or A_0, in the **Liu or Cheng** model with a function, such as S(z) as taught in **Park** or with a quadratic spline approximation as taught in **Barby,** to guarantee continuity of the function and its first derivative. **(Park page 379, lines 9-10 and Barby page 558, column 1, paragraph 5)**.

41. Further, it is noted that the compensation function, $\frac{A_0}{K}$, is simply a constant for a given value of A_0. This conclusion was made based on the fact that K is "any positive number substantially greater that unity" (specification, page 10, line 11), therefore, an arbitrary constant. A_0 is also an arbitrary constant that can take on a range of values. One constant divided by another constant is simply a constant. Therefore, the compensation function as described in **Claims 4 and 14** can take on the same values as the original variable parameter, δ, described in **Liu and Cheng**.

Allowable Subject Matter

42. **Claims 6-10 and 16-20** are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

Conclusion

43. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Mary C. Hogan whose telephone number is 703-305-7838. The examiner can normally be reached on 7:30AM-5PM Monday-Friday. If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Kevin Teska can be reached on 703-305-9704. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306. Inquiries of a general nature relating to the general status of this application or proceeding should be directed to the 2100 Group receptionist whose telephone number is 703-305-3900.

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